

### **Claims**

I/We claim:

1. A method of operating an off-board device to communicate with a diagnostic system of a vehicle, the diagnostic system having one or more modules, comprising the steps of:
  - 5 (a) requesting data from one or more of the diagnostic system modules using a first communications protocol;
  - (b) determining a number of pieces of information received from the one or more modules using the first communications protocol;
  - (c) requesting data from one or more of the diagnostic system modules using a  
10 second communications protocol;
  - (d) determining a number of pieces of information received from the one or more modules using the second communications protocol;
  - (e) selecting from the plurality of communications protocols a communications  
15 protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol and the number of pieces of information received from the one or more modules using the second communications protocol; and
  - (f) communicating between the off-board device and the diagnostic system using the  
20 selected communications protocol.
  
2. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 further comprising the steps of:
  - requesting data from one or more of the diagnostic system modules using a third  
25 communications protocol; and
  - determining a number of pieces of information received from the one or more modules using the third communications protocol; and

wherein said step (e) comprises the step of selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol, the number of pieces of information received from the one or more modules using the second communications protocol, and the number of pieces of information received from the one or more modules using the third communications protocol.

3. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 further comprising the steps of:  
requesting data from one or more of the diagnostic system modules using a fourth communications protocol; and

determining a number of pieces of information received from the one or more modules using the fourth communications protocol; and

wherein said step (e) comprises the step of selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol, the number of pieces of information received from the one or more modules using the second communications protocol, the number of pieces of information received from the one or more modules using the third communications protocol, and the number of pieces of information received from the one or more modules using the fourth communications protocol.

4. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein said step (b) comprises the step of determining a number of diagnostic monitors available using the first communications

protocol, wherein said step (d) comprises the step of determining a number of diagnostic monitors available using the second communications protocol, and wherein said step (e) comprises the step of selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of diagnostic monitors available using the first communications protocol and the number of diagnostic monitors available using the second communications protocol.

5. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein said step (b) comprises the step of determining a number of diagnostic monitors available using the first communications protocol, wherein said step (d) comprises the step of determining a number of diagnostic monitors available using the second communications protocol, and wherein said step (e) comprises the step of selecting from the plurality of communications protocols the communications protocol that makes available the highest number of diagnostic monitors.

6. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 2:

wherein said step of determining a number of pieces of information received from the one or more modules using the first communications protocol comprises the step of determining a number of diagnostic monitors available using the first communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the second communications protocol comprises the step of determining a number of diagnostic monitors available using the second communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the third communications protocol comprises the step of

determining a number of diagnostic monitors available using the third communications protocol; and

5 wherein said step (e) comprises the step of selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of diagnostic monitors available using the first communications protocol, the number of diagnostic monitors available using the second communications protocol, and the number of diagnostic monitors available using the third communications protocol.

10 7. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 2:

15 wherein said step of determining a number of pieces of information received from the one or more modules using the first communications protocol comprises the step of determining a number of diagnostic monitors available using the first communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the second communications protocol comprises the step of determining a number of diagnostic monitors available using the second communications protocol;

20 wherein said step of determining a number of pieces of information received from the one or more modules using the third communications protocol comprises the step of determining a number of diagnostic monitors available using the third communications protocol; and

25 wherein said step (e) comprises the step of selecting from the plurality of communications protocols the communications protocol that makes available the highest number of diagnostic monitors.

8. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 3:

wherein said step of determining a number of pieces of information received from the one or more modules using the first communications protocol comprises the step of  
5 determining a number of diagnostic monitors available using the first communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the second communications protocol comprises the step of  
10 determining a number of diagnostic monitors available using the second communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the third communications protocol comprises the step of  
15 determining a number of diagnostic monitors available using the third communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the fourth communications protocol comprises the step of  
determining a number of diagnostic monitors available using the fourth communications  
protocol; and

20 wherein said step (e) comprises the step of selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of diagnostic monitors available using the first communications protocol, the number of diagnostic  
monitors available using the second communications protocol, the number of diagnostic  
25 monitors available using the third communications protocol, and the number of diagnostic  
monitors available using the fourth communications protocol.

9. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 3:

5 wherein said step of determining a number of pieces of information received from the one or more modules using the first communications protocol comprises the step of determining a number of diagnostic monitors available using the first communications protocol;

10 wherein said step of determining a number of pieces of information received from the one or more modules using the second communications protocol comprises the step of determining a number of diagnostic monitors available using the second communications protocol;

15 wherein said step of determining a number of pieces of information received from the one or more modules using the third communications protocol comprises the step of determining a number of diagnostic monitors available using the third communications protocol;

wherein said step of determining a number of pieces of information received from the one or more modules using the fourth communications protocol comprises the step of determining a number of diagnostic monitors available using the fourth communications protocol; and

20 wherein said step (e) comprises the step of selecting from the plurality of communications protocols the communications protocol that makes available the highest number of diagnostic monitors.

10. A method of operating an off-board device to communicate with a diagnostic system of a vehicle, the diagnostic system having one or more modules, comprising the steps of:

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(a) sequentially requesting data from one or more of the diagnostic system modules using a plurality of different communications protocols, one communications protocol at a time;

5 (b) for each of the communications protocols, receiving data if any from the one or more modules using the communications protocol;

(c) using at least the received data, selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system; and

10 (d) communicating between the off-board device and the diagnostic system using the selected communications protocol.

11. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 10 further comprising the step of determining, for each of the communications protocols, a number of pieces of information received from the one or  
15 more modules using the communications protocol, and wherein said step (c) comprises the step of selecting from the plurality of communications protocols the communications protocol that makes available the highest number pieces of information.

12. The method of operating an off-board device to communicate with the diagnostic  
20 system of the vehicle according to claim 10 further comprising the step of determining, for each of the communications protocols, a number of diagnostic monitors available using the communications protocol, and wherein said step (c) comprises the step of selecting from the plurality of communications protocols the communications protocol that makes available the highest number of diagnostic monitors.

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13. An off-board device that communicates with a diagnostic system of a vehicle, the diagnostic system having one or more modules, comprising:

(a) means for requesting data from one or more of the diagnostic system modules using a first communications protocol;

(b) means for determining a number of pieces of information received from the one or more modules using the first communications protocol;

5 (c) means for requesting data from one or more of the diagnostic system modules using a second communications protocol;

(d) means for determining a number of pieces of information received from the one or more modules using the second communications protocol;

10 (e) means for selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol and the number of pieces of information received from the one or more modules using the second communications protocol; and

15 (f) means for communicating between the off-board device and the diagnostic system using the selected communications protocol.

14. An off-board device that communicates with a diagnostic system of a vehicle, the diagnostic system having one or more modules, comprising:

20 (a) means for sequentially requesting data from one or more of the diagnostic system modules using a plurality of different communications protocols, one communications protocol at a time;

(b) means for, for each of the communications protocols, receiving data if any from the one or more modules using the communications protocol;

25 (c) means for using at least the received data, selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system; and

(d) means for communicating between the off-board device and the diagnostic system using the selected communications protocol.



15. A method of operating an off-board device to communicate with a diagnostic system of a vehicle, the diagnostic system having one or more modules, comprising the steps of:

- 5 (a) selecting a communications protocol to use to communicate between the off-board device and the diagnostic system;
- (b) sending an initial request using the selected communications protocol that will prompt a response from the modules;
- (c) storing information received from the modules in response to the initial request;
- (d) requesting data from one or more of the diagnostic system modules using the  
10 selected communications protocol;
- (e) determining whether one or more of the modules has ceased to communicate using the selected communications protocol by performing at least the steps of (i) sending a subsequent request using the selected communications protocol that will prompt a response from the modules, (ii) receiving information from the modules in response to the subsequent  
15 request, and (iii) comparing the stored information received from the modules in response to the initial request with the information received from the modules in response to the subsequent request.

20 16. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a partial reinitialization of the one or more modules that has ceased to communicate.

25 17. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected

communications protocol, executing a complete reinitialization of the one or more modules that has ceased to communicate.

18. The\_method of operating an off-board device to communicate with the diagnostic  
5 system of the vehicle according to claim 15 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a partial reinitialization of the selected communications protocol.

10 19. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a complete reinitialization of the selected communications protocol.

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20. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 wherein said step (c) comprises the step of storing module identification information for each module that responded to the initial request and wherein said step (e)(iii) comprises the step of comparing the identification of the modules that  
20 responded to the initial request with the identification of the modules that responded to the subsequent request.

21. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 20 further comprising the step of, responsive to  
25 determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a partial reinitialization of the one or more modules that has ceased to communicate.

22. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 20 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a complete reinitialization of the one or more modules that has ceased to communicate.

23. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 20 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a partial reinitialization of the selected communications protocol.

24. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 20 further comprising the step of, responsive to determining that one or more of the modules has ceased to communicate using the selected communications protocol, executing a complete reinitialization of the selected communications protocol.

25. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15:

further comprising the step of determining whether one or more additional modules has begun to communicate using the selected communications protocol by at least comparing the stored information received from the modules in response to the initial request with the information received from the modules in response to a subsequent request and,

responsive to determining that one or more additional modules has begun to communicate using the selected communications protocol, updating the information received from the modules in response to the initial request, and

further wherein said step (e)(iii) comprises the step of comparing the updated stored information received from the modules in response to the initial request with the information received from the modules in response to the subsequent request.

5     26.     The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 wherein said step (a) comprises the steps of:

          (1) requesting data from one or more of the diagnostic system modules using a first communications protocol;

          (2) determining a number of pieces of information received from the one or more  
10     modules using the first communications protocol;

          (3) requesting data from one or more of the diagnostic system modules using a second communications protocol;

          (4) determining a number of pieces of information received from the one or more modules using the second communications protocol; and

15           (5) selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol and the number of pieces of information received from the one or more modules using the second communications  
20     protocol.

27.     The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 wherein said step (a) comprises the steps of:

          (1) requesting data from one or more of the diagnostic system modules using a first  
25     communications protocol;

(2) determining a number of pieces of information received from the one or more modules using the first communications protocol;

(3) requesting data from one or more of the diagnostic system modules using a second communications protocol;

5       (4) determining a number of pieces of information received from the one or more modules using the second communications protocol;

(5) requesting data from one or more of the diagnostic system modules using a third communications protocol;

10       (6) determining a number of pieces of information received from the one or more modules using the third communications protocol;

(7) requesting data from one or more of the diagnostic system modules using a fourth communications protocol;

(8) determining a number of pieces of information received from the one or more modules using the fourth communications protocol; and

15       (9) selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system using at least the number of pieces of information received from the one or more modules using the first communications protocol, the number of pieces of information received from the one or more modules using the second communications protocol, the  
20       number of pieces of information received from the one or more modules using the third communications protocol, and the number of pieces of information received from the one or more modules using the fourth communications protocol.

28.     The\_method of operating an off-board device to communicate with the diagnostic  
25     system of the vehicle according to claim 15 wherein said step (a) comprises the steps of:

(1) sequentially requesting data from one or more of the diagnostic system modules using a plurality of different communications protocols, one communications protocol at a time;

5 (2) for each of the communications protocols, receiving data if any from the one or more modules using the communications protocol; and

(3) using at least the received data, selecting from the plurality of communications protocols a communications protocol to use for subsequent communications between the off-board device and the diagnostic system.

10 29. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 wherein said step (a) comprises the steps of:

(1) sequentially requesting data from one or more of the diagnostic system modules using a plurality of different communications protocols, one communications protocol at a time;

15 (2) for each of the communications protocols, receiving data if any from the one or more modules using the communications protocol;

(3) determining, for each of the communications protocols, a number of diagnostic monitors available using the communications protocol; and

20 (4) selecting from the plurality of communications protocols the communications protocol that makes available the highest number of diagnostic monitors.

30. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 15 wherein upon determining one or more of the modules has ceased to communicate using the selected communications protocol, the method further comprises:

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prompting a user to determine whether to continue receiving data without the one or more modules that have ceased to communicate using the selected communications protocol.

5        31.    The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein the pieces of information used to select from the plurality of communications protocols comprises the most relevant data.

10       32.    The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein the pieces of information used to select from the plurality of communications protocols comprises emissions data.

15       33.    The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein selecting from the plurality of communications protocols for subsequent communications comprises selecting the communications protocol that returned the most pieces of information.

20       34.    The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 33 wherein selecting from the plurality of communications protocols for subsequent communications comprises selecting a communications protocol from a predetermined list if a plurality of communications protocols return an equal number of pieces of information and the equal number of pieces of information are the most pieces of information.

35. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein the off-board device automatically selects the communications protocol based on at least the number of pieces of information received from the one or more modules using the first communications protocol and the number of pieces of information received from the one or more modules using the second communications protocol.

36. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 1 wherein a user selects the communications protocol based on at least the number of pieces of information received from the one or more modules using the first communications protocol and the number of pieces of information received from the one or more modules using the second communications protocol.

37. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 10 wherein the pieces of information used to select from the plurality of communications protocols comprises the most relevant data.

38. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 10 wherein the pieces of information used to select from the plurality of communications protocols comprises emissions data.

39. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 10 wherein selecting from the plurality of communications protocols for subsequent communications comprises selecting the communications protocol that returned the most pieces of information.



40. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 39 wherein selecting from the plurality of communications protocols for subsequent communications comprises selecting a  
5 communications protocol from a predetermined list if a plurality of communications protocols return an equal number of pieces of information and the equal number of pieces of information are the most pieces of information.

41. The method of operating an off-board device to communicate with the  
10 diagnostic system of the vehicle according to claim 13 wherein the pieces of information received from the modules used to select from the plurality of communications protocols comprises the most relevant data.

42. The method of operating an off-board device to communicate with the  
15 diagnostic system of the vehicle according to claim 13 wherein the pieces of information used to select from the plurality of communications protocols comprises emissions data.

43. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 13 wherein selecting from the plurality of  
20 communications protocols for subsequent communications comprises selecting the communications protocol that returned the most pieces of information.

44. The method of operating an off-board device to communicate with the diagnostic system of the vehicle according to claim 43 wherein selecting from the plurality of  
25 communications protocols for subsequent communications comprises selecting a

communications protocol from a predetermined list if a plurality of communications protocols return an equal number of pieces of information and the equal number of pieces of information are the most pieces of information.